2001 Matney Creek and Dwyer Creek Subwatershed Survey: Habitat and Benthic Macroinvertebrates

Clark County Public Works
Water Resources Section

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Lacamas Lake Restoration Program Advisory Committee
Clark County Clean Water Commission

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Special thanks to the participating landowners. Your cooperation made this project possible, and your support is greatly appreciated.

1.0 Introduction

1.1 Purpose

This report briefly summarizes the planning, field activities, and results of a prototype survey of habitat and biological health at seven sites in the Matney Creek and Dwyer Creek subwatersheds in Clark County.

This project was co-sponsored by Clark County's Lacamas Lake Restoration Program (LLRP) and NPDES Clean Water Program (CWP).

The project was designed with several purposes in mind, including:

1) Determine the feasibility of accessing private lands for monitoring projects.

2) Enhance existing knowledge about the Matney Creek and Dwyer Creek subwatersheds for use in developing an interim Lacamas Creek watershed plan.

3) Test a prototype for conducting subwatershed-scale stream habitat and biological health surveys in Clark County watersheds.

2.0 Methods

2.1 Site selection process

The project objective was to evaluate approximately 10 locations within three sub-watersheds of the Lacamas Creek watershed. Matney Creek, Dwyer Creek, and China Ditch sub-watersheds were selected as representative of a variety of land-use types within the watershed (See Figures 2 and 3): Matney Creek contains areas of agriculture, forest, and large-lot residential development. Dwyer Creek has experienced significant land-use conversion from agriculture to urban residential and commercial development. China Ditch remains largely agricultural, with areas of residential development. As part of a separate project, data were collected from a high quality site on Jones Creek, in the nearby Washougal River watershed. These data were used for comparison purposes.

Standard monitoring protocols for habitat and benthic macroinvertebrates require access to stream reaches at least 400 feet long. Therefore, in most locations it was necessary to obtain permission to enter private property.

Potential monitoring sites were identified using the county's Geographic Information System (GIS). First, all public road crossings over each creek were located on a computer-generated map. Starting from each road crossing, 500-foot stream reaches were delineated both upstream and downstream. A list was compiled of all landowners with property bordering the creek within the 500-foot stream reaches.

An inquiry letter was sent to each landowner, requesting permission to access the property during the survey. A total of 79 letters were mailed. Copies of the inquiry letter are on file with Clark County.

Responses to the letter were recorded and mapped. A set of seven monitoring sites was selected from the locations where access was granted, with the secondary goal of distributing monitoring sites evenly throughout the subwatersheds.

Figure 1 depicts the location of the Matney Creek and Dwyer Creek subwatersheds within the Lacamas Creek watershed. Figure 2 and Figure 3 show the locations of the Matney and Dwyer subwatershed monitoring sites, respectively.

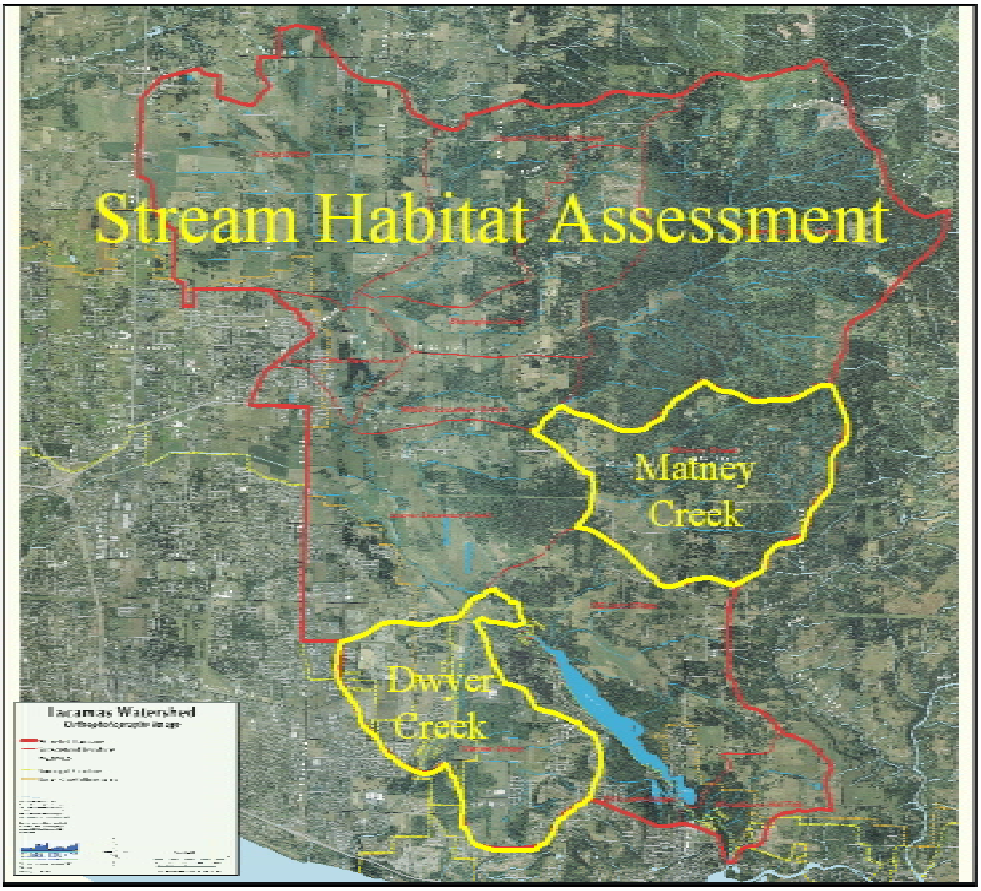

Figure 1. Location of the Dwyer Creek and Matney Creek subwatersheds within the Lacamas Creek watershed.

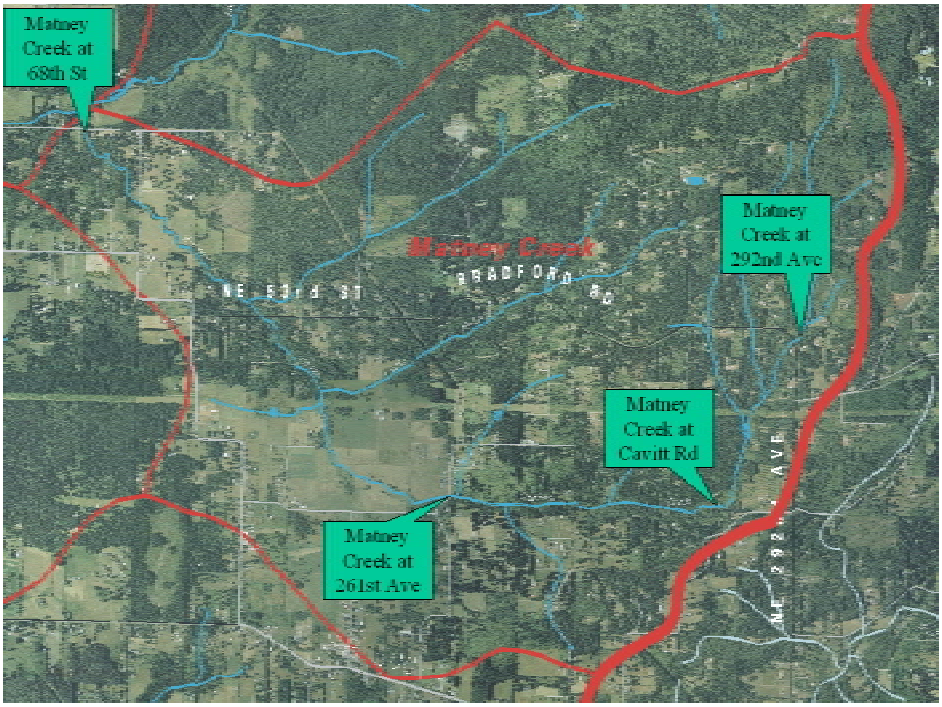

Figure 2. Matney Creek habitat and benthic macroinvertebrate monitoring sites, 2001.

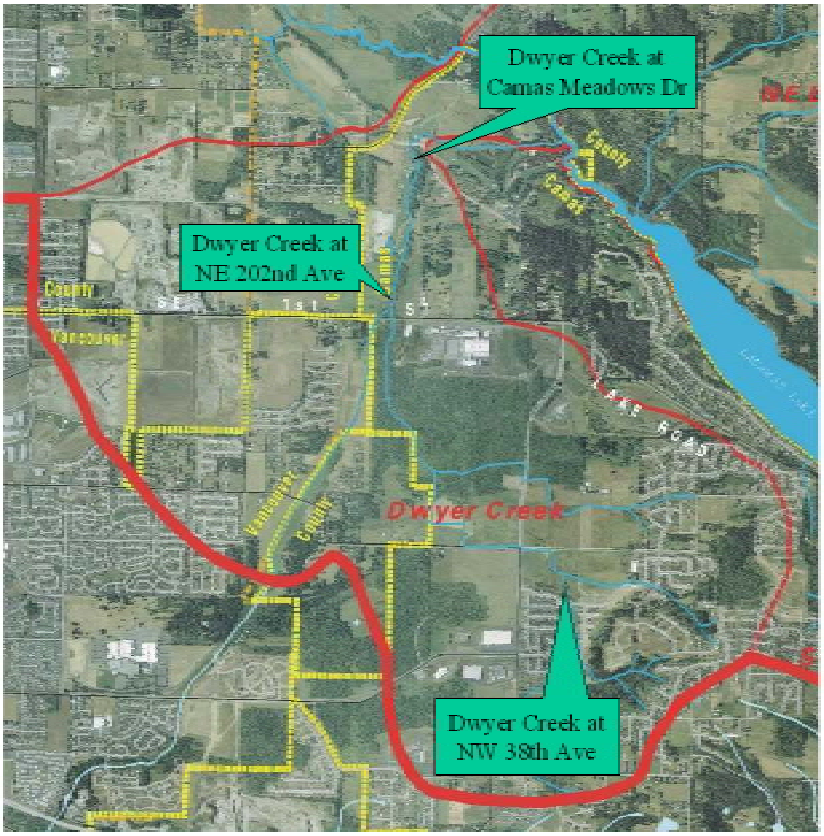

Figure 3. Dwyer Creek habitat and benthic macroinvertebrate monitoring sites, 2001.

2.2 Field methods

Monitoring was performed at the Matney Creek sites on September 19-21, 2001, and the Dwyer Creek sites on September 24, 2001.

2.2.1 Habitat

Habitat monitoring was performed according to a modified version of the U.S. Environmental Protection Agency (EPA) Rapid Habitat Assessment protocol (1999).

Each stream was visually evaluated for a distance of approximately 40 times the average stream width. In most cases, this amounted to a 400-800 foot stream reach. Ten habitat parameters were scored from 0-20 points each, for a total possible score of 200. Due to the subjective nature of visual surveys, all surveys were conducted by a team of three trained staff members. Differences in opinion were discussed on-site until consensus was reached. Final scores fall into one of four habitat quality categories: Poor (0-50), Marginal (50-100), Sub-optimal (100-150), and Optimal (150-200).

A slightly different set of parameters is used for low gradient (<5% slope) and high gradient (>5% slope) streams because optimal habitat conditions differ depending on the slope of the stream channel. The parameters for high and low gradient streams and a brief description of each are included in Table 1.

2.2.2 Benthic Macroinvertebrates (Bugs)

Benthic macroinvertebrate samples were collected according to the State of Washington Department of Ecology (Ecology) protocol (Plotnikoff, 2001). Four riffles were selected at each site. A D-frame net was placed in the stream perpendicular to the stream flow, and a 2-ft^2 area upstream of the net was disturbed. Rocks larger than 2" in diameter were scrubbed by hand, and the substrate was disturbed to a depth of 4". Organisms were placed in the net or swept into the net by the streamflow. The four riffle samples were composited into a single sample representing the entire site.

Composite samples were stored in 1-L Nalgene bottles. Macroinvertebrate samples were preserved with 95% ethanol and placed in coolers for delivery to the office. Samples were refrigerated until delivery to the lab for analysis.

2.3 Laboratory Methods

Laboratory analysis of the bug samples was performed by Aquatic Biology Associates, Inc. (ABA) in Corvallis, Oregon. Samples were processed and analyzed according to standard Ecology protocols (Plotnikoff, 2001). A minimum of 500 organisms are identified from each sample, usually down to the species level. Results are categorized into various "metrics" based on species, feeding method, sensitivity to pollution, and other factors.

Several standard population metrics are combined to form an aggregate score called the Benthic Index of Biological Integrity (B-IBI) (Karr, 1987). This score may range from 10 to 50, and the results are grouped into three categories of biological integrity or health: Low integrity (10-24), Moderate integrity (25-39), and High integrity (>40). High integrity indicates that the stream is healthy and capable of supporting optimal levels of aquatic life.

Low Gradient Streams (<5% slope)

Habitat Parameter	General question
Epifaunal substrate	Are there rocks, snags, etc that provide cover for fish and bugs
Pool substrate	What kind of material is at the bottom of the pools
Pool variability	Is there a good mix of large, deep, small, and shallow pools
Sediment deposition	Is there excessive sediment deposition
Channel flow status	Does the channel have water from bank to bank
Channel alteration	Has the channel been constricted by man-made means
Channel sinuosity	Does the stream meander naturally
Bank stability	Is there significant bank erosion
Bank vegetative cover	Is the riparian vegetation thick and is it native
Riparian vegetation width	How wide is the riparian forest zone

High Gradient Streams (>5% slope)

Habitat Parameter	General question
Epifaunal substrate	Are there rocks, snags, etc that provide cover for fish and bugs
Embeddedness	How much fine sediment is packed around the gravel
Velocity/Depth Regime	Is there a good mix of fast, slow, shallow, and deep areas
Sediment movement	Is there significant transport of material into or out of the reach
Channel flow status	Does the channel have water from bank to bank
Channel alteration	Has the channel been constricted by man-made means
Frequency of riffles	How much riffle habitat is present
Bank stability	Is there significant bank erosion
Bank vegetative cover	Is the riparian vegetation thick and is it native
Riparian vegetation width	How wide is the riparian forest zone

Table 1: Habitat parameters evaluated in the EPA Rapid Habitat Assessment protocol (simplified from field form).

3.0 Results

3.1 Access

Landowner response to the letter of inquiry was very positive. Out of 79 letters mailed, 47 responses were received (a return rate of 59%). Forty-one of the 47 responders granted permission to access their property (87%).

Though many positive responses were received from private landowners in the China Ditch subwatershed, the commissioners of the China Ditch Drainage Improvement District (DID #5) asked that the county not collect data from within their system. DID #5 is responsible for maintaining the laterals and ditches of the China Ditch drainage system. The China Ditch subwatershed was therefore eliminated from the project scope.

3.2 Habitat

Figure 4 shows the overall results of the Rapid Habitat Assessment in Matney and Dwyer Creeks, respectively. A high-quality site at Jones Creek (in the Washougal River watershed) is included for comparison.

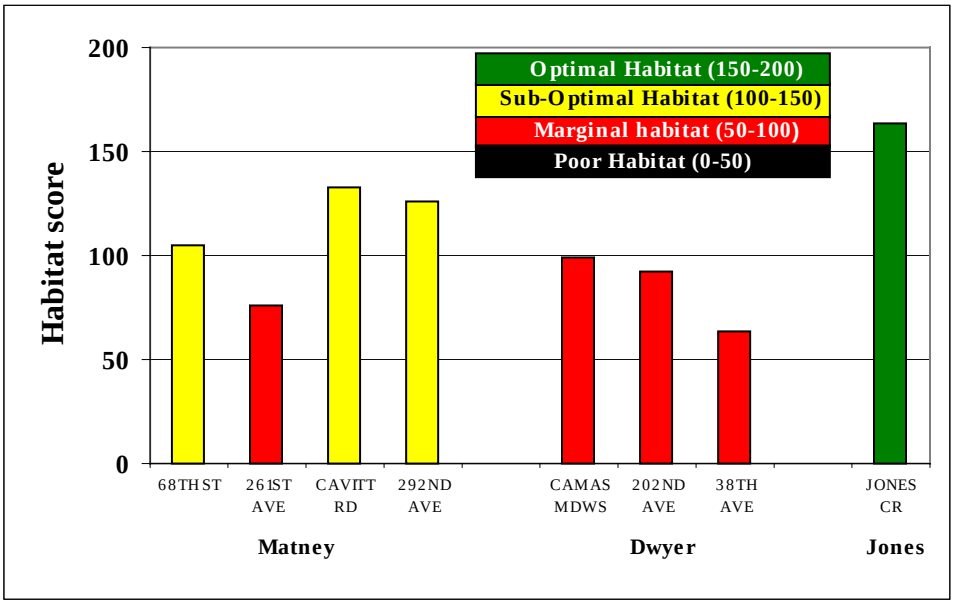

Figure 4. Matney Creek and Dwyer Creek EPA Rapid Habitat Assessment scores, 2001. Jones Creek site included for comparison.

A maximum score of 200 is possible. Scores in the Matney subwatershed ranged from 76 at the NE 261st Street site to 133 at the Cavitt Road site, with the 292nd Avenue and 68th Street sites at 126 and 105, respectively. In Dwyer Creek, scores ranged from 63 at NW 38th Avenue to 99 at Camas Meadows Drive, while the site at NE 202nd Avenue scored 92. The Jones Creek comparison site scored 163.

3.3 Benthic Macroinvertebrates

A maximum B-IBI score of 50 is possible. B-IBI scores for the Matney Creek and Dwyer Creek sites are shown in Figure 5. A high quality site at Jones Creek (in the Washougal River watershed) is included for comparison.

Scores in the Matney Creek subwatershed ranged from 22 at the Cavitt Road site to 42 at NE 292nd Avenue, while the 68th Street and 261st Avenue sites scored 34 and 24, respectively. In Dwyer Creek, the Camas Meadows Road site scored 22 and NE 202nd Avenue scored 26. No benthic invertebrate sample was collected at the NW 38th Avenue site because it was lacking suitable riffle habitat. The Jones Creek comparison site scored 46.

3.4 Habitat and Bugs vs Road Density

Road density (miles of road/mile^2) or other land-use factors are sometimes used to estimate the amount of human impact on watersheds and predict relative stream health. In this study, road density (which includes both public and private roads and driveways) was calculated for the areas draining to each of the monitoring sites. Habitat scores and bug scores were plotted against the road density to determine whether a relationship exists between these factors.

Although there are few data points, we can begin to see possible patterns. In general, as the road density increases, both habitat quality and biological integrity tend to decrease. As more sites are analyzed in the County, the statistical relationships between various factors should become stronger. Figure 6 and Figure 7 are included as preliminary examples of these possible relationships.

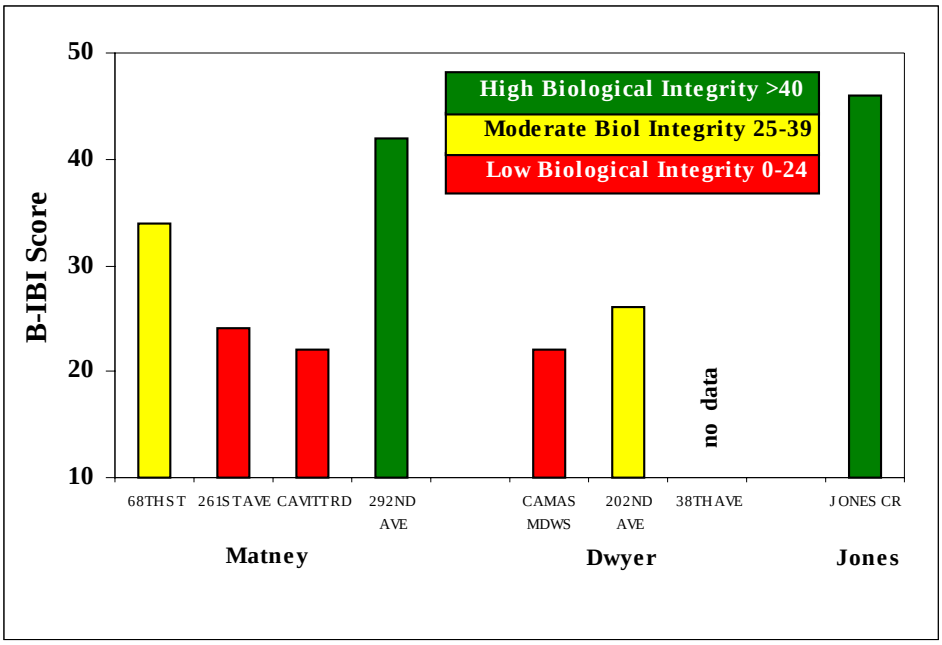

Figure 5. Matney Creek and Dwyer Creek B-IBI scores, August 2001. Jones Creek included for comparison.

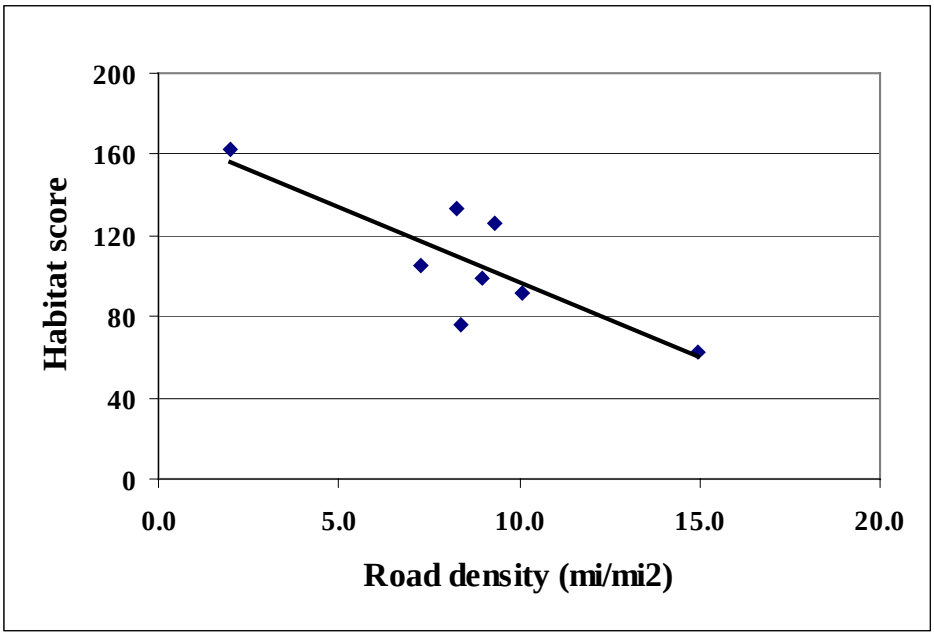

Figure 6. Habitat score vs. road density, Matney and Dwyer Creek sites, 2001. Also includes Jones Creek comparison site.

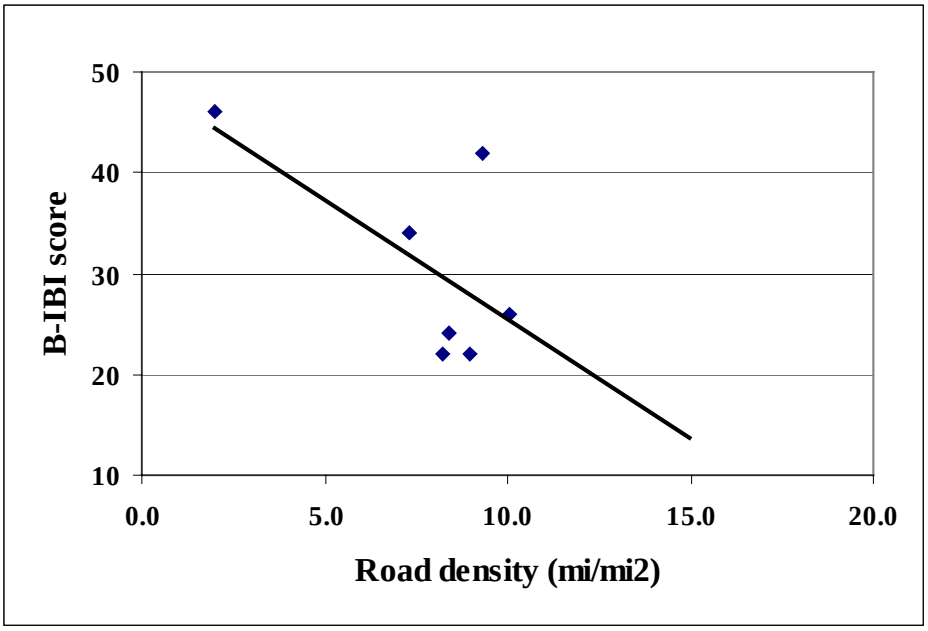

Figure 7. Bug (B-IBI) score vs. road density, Matney and Dwyer Creek sites, 2001. Also includes Jones Creek comparison site.

4.0 Discussion

4.1 Feasibility of Accessing Private Lands

Based on the response to this survey request, it appears that accessing private lands for one-time stream studies is a viable approach. The positive response rate was 52%. This was considerably higher than anticipated. In fact, so many sites were made available that we were unable to include all of them under the scope of this project. Even if positive responses in other areas of Clark County are significantly lower, it appears that sufficient sites should be available for similar projects.

An important secondary benefit of this approach was also evident. Communication with streamside landowners during this project resulted in several opportunities for staff to address public inquiries and provide additional information. In some cases, interested landowners were put in contact with other organizations, such as the Clark Conservation District and the Columbia Land Trust, for assistance in enhancing and managing their property.

4.2 Enhance Existing Knowledge about Matney and Dwyer Creeks

The second purpose of this project was to enhance existing knowledge about the Matney Creek and Dwyer Creek subwatersheds for Lacamas Creek watershed planning. The watershed analysis and plan were developed through Clark County's grant-funded Lacamas Lake Restoration Program. The Lacamas grant program concluded in December 2001. The following is a general discussion of conditions at the monitored sites:

Overall, habitat quality and biological integrity varied with the degree of human disturbance in the subwatersheds.

Jones Creek Reference Site: Reference sites are areas which can be compared to other sites with similar natural characteristics in order to gauge the impact from human activities. If a reference site begins to show signs of degradation, it may mean that climatic or natural hydrologic factors are influencing all of the streams in the surrounding area. Conversely, if the reference site remains healthy while similar sites nearby begin to degrade, it may mean that human activities are having a negative impact on stream health.

The Jones Creek site is located on land owned by the City of Camas, upstream from the City's public water supply intake. The area is closed to public entry and has very few roads. Although the area has been logged historically, the entire watershed above the sampling site is currently forested. The fact that this area is minimally impacted by human activities makes it a good reference or comparison site candidate.

In 2001, the Jones Creek site scored in the highest category for both biological integrity and habitat condition. It also has the lowest road density of any of the monitoring sites at approximately 2 miles of road per square mile.

Matney Creek: Results for the Matney Creek subwatershed are generally consistent with what might be expected in a developing rural area. Land use patterns are altered from their pre-development forested condition. The highest occurrence of residential development and agricultural clearing is in the middle of the subwatershed. Throughout the subwatershed, road

densities are considerably higher than in Jones Creek, ranging from approximately 7-9 miles of road per square mile.

Habitat and benthic invertebrate scores were lower than the Jones Creek scores at all monitored sites, but some sites still exhibit good habitat characteristics and moderate to high B-IBI scores.

The 261st Ave site was the only site exhibiting both low biological integrity and marginal habitat quality. This area is the most intensively cleared site, and has been subjected to historical modifications such as channel straightening and wetland draining to a greater extent than the other sites.

The Cavitt Road site is the only site where habitat and benthic invertebrate scores did not match well with each other. This site was characterized by a series of natural beaver ponds and wetlands. These characteristics resulted in generally good habitat scores, but the slower moving, ponded water is not prime benthic invertebrate habitat and resulted in a low score for biological integrity. Despite the low B-IBI score, this area represents an important piece of intact wetland, serving to control runoff, provide wildlife habitat, and facilitate groundwater recharge.

Based on the overall habitat and B-IBI scores, the Matney subwatershed has reduced biological integrity and habitat quality due to human activity (compared to a forested condition). However, many parts of the stream system remain healthy or are only moderately impaired.

Dwyer Creek: Land cover in the Dwyer Creek subwatershed has been significantly altered from its historical condition. In this rapidly developing area, nearly all of the native forest has been cleared to make room for agriculture, residential and commercial development, gravel mining, and golf courses. Road densities in Dwyer Creek range from 9-15 miles of road per square mile, with the highest densities occurring in the headwater region.

Habitat and biological integrity scores in Dwyer Creek were consistently much lower than the Jones Creek site, and generally lower than the Matney Creek sites. All three monitoring sites in Dwyer Creek exhibited only marginal habitat, and the two sites with B-IBI scores ranked in the low and moderate categories for biological integrity. The 38th Ave site was not sampled for benthic invertebrates because not enough suitable habitat could be found to collect a proper sample. In this situation, it is very likely that the biological integrity of the site is quite low.

Based on overall scores, the habitat and biological integrity of the Dwyer Creek subwatershed is significantly degraded by human activities. Few areas of native forest remain intact, and the biological and habitat conditions are uniformly degraded throughout much of the area when compared to the likely historical condition represented by Jones Creek.

4.3 Test a prototype for conducting future habitat and biological health surveys

The final purpose of this prototype study was to determine whether this approach would be useful in future planning and monitoring efforts. To that end, this project utilized protocols already in use by the county and other jurisdictions to collect comparable data. As a result, data collected for this project can be easily combined with data from other county or outside agency projects to form larger, comprehensive data sets. Some of this compilation has already occurred, allowing the county to utilize these data for multiple purposes.

The apparent openness of private landowners to allow access to streams, coupled with the public outreach benefits, also encourages the use of this format in other areas.

Field work for this project was completed at the rate of 2-3 sites per day. At this rate, a large number of sites can be surveyed in a short time-frame, which is often critical when collecting characterization data for basin planning efforts.

Based on this initial trial, the study format appears to offer a straightforward and reproducible means to collect basic watershed characterization information in a timely manner. Two possible modifications to the protocol are:

1) Revise criteria separating low and high gradient streams. Since a 5% gradient is quite steep, most streams tend to be grouped in the "low gradient" category. Using a 3% gradient as the distinction between low and high gradient streams would ensure that streams in each category exhibit more similar morphological and flow conditions.

2) Add a requirement to document the reason for any habitat score that was not unanimously agreed upon. This would add an additional level of quality control and consistency among measurements.

With minor modifications such as these, and somewhat more in depth data analysis, this prototype should lend itself to short-term, intensive monitoring projects related to Clark County's capital improvement planning, watershed characterization, and basin planning efforts.

References

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Plotnikoff, R. (June 2001). *Benthic Macroinvertebrate Biological Monitoring Protocols for Rivers and Streams.* 2001 revision. Washington Department of Ecology.

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